MICROFILM SCANNER

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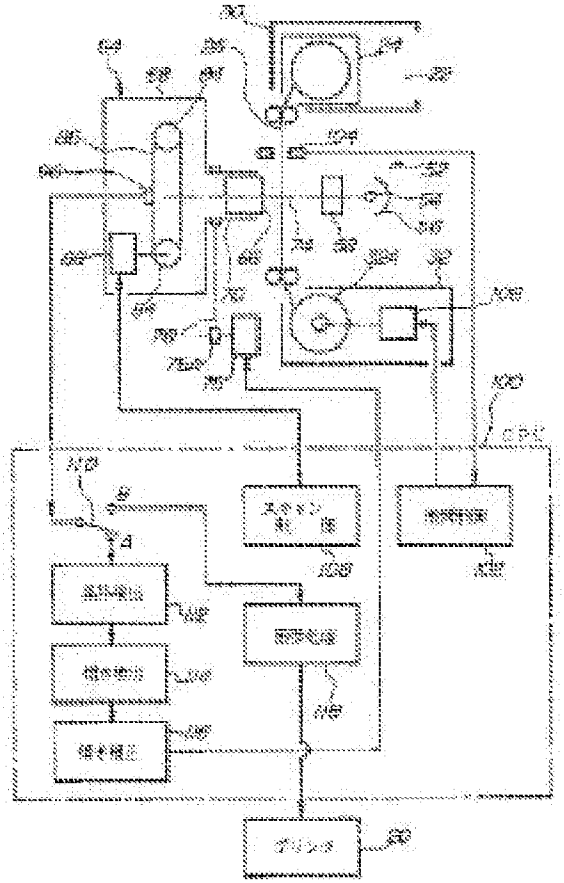
Abstract of **JP 8163328 (A)**

PURPOSE: To make an entire scanner small by arranging a projection lens between a film and an image forming face and reading an image while a line sensor is moved in parallel and rotated on the image forming face thereby making the size of an optical system small. CONSTITUTION: In the preliminary scanning, a scan control means 108 throws a changeover switch 110 to the position of A, a lamp 54 is lighted and a frame image is magnified by a projection lens and projected to a moving base 80. The base 80 is driven by a motor 88 so that a line sensor 96 is moved from one side of the entire projected image to the other side. The sensor 96 reads a projected image on an image forming face for that time. A CPU 100 uses a black frame detection means 112 to obtain a black frame included in the projected image and a tilt detection means 114 obtains a tilt of an image based on the black frame to allow a motor 76 to drive the rotary frame 68 so as to set a tilt to be zero. After the preliminary scanning, the switch 110 is turned to the position of B, and main scanning is conducted. The sensor 96 reads an image



again and its output is processed by
an image processing means 118
and outputted to a printer 20.

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NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A microfilm scanner which reads a picture of a microfilm using a line sensor, comprising:
A projection lens of a fixed focus allocated between a microfilm and an image formation face so that image formation of the projection picture might be carried out on an image formation face parallel to a microfilm.
A rotational frame held pivotable on a fixed frame to which said projection lens is attached at a circumference of an axis parallel to an optic axis of said projection lens.
A line sensor which is attached to this rotational frame, carries out parallel translation on said image formation face, and reads a projection picture.
An inclination detecting means which detects inclination of a projection picture read with said line sensor.
An inclination correction control means which amends inclination for which it asked by rotating said rotational frame.

[Claim 2]A rotational frame is a microfilm scanner of pivotable claim 1 focusing on an axis biased to the position side which is parallel to an optic axis of a projection lens, and has a manuscript picture of film projection within the limits.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the microfilm scanner which reads the picture of a microfilm using a line sensor.
[0002]
[Description of the Prior Art]The microfilm scanner which read the picture of the microfilm using image sensors, such as a line sensor, is proposed. Thus, by reading a picture with an image sensor, image processing is performed as a digital image signal, and it becomes easy to output to a printer, to carry out a memory to a magneto-optical disc etc., or to transmit to other image processing devices.
[0003]Extended projection of the projection picture of a film is greatly carried out to a screen, using a reflector as such a device, and there are some which read this expanded picture with a

CCD line sensor.
[0004]In this case, if the picture photoed by the microfilm leans, the picture leaning also to the screen will be projected. Then, while an operator looks at a screen, after correcting inclination of a picture, the picture is read with the line sensor. Inclination correction of this picture was made by making an image rotating prism placed between optical systems, and rotating this prism with a servo motor.
[0005]
[Description of the Prior Art]Thus, with the conventional device, since the projection picture was expanded using two or more reflectors, there was a problem that a device was enlarged. If an image rotating prism is a big optical system in this way, it is also possible to also secure receiving space, but there are problems, like when an optical system is made small, it becomes impossible to secure the receiving space, and the miniaturization of a device becomes difficult.
[0006]
[Objects of the Invention]This invention is made in view of such a situation, inclination correction of a picture can be made, without using an image rotating prism, and it aims at providing a micro scanner suitable for the miniaturization of the whole device, especially the miniaturization of an optical system.
[0007]
[Elements of the Invention]In a microfilm scanner which reads a picture of a microfilm which stored this purpose to a cartridge in this invention using a line sensor, A projection lens of a fixed focus allocated between a microfilm and an image formation face so that image formation of the projection picture might be carried out on an image formation face parallel to a microfilm, A rotational frame held pivotable on a fixed frame to which said projection lens is attached at a circumference of an axis parallel to an optic axis of said projection lens, Said rotational frame is rotated for a line sensor which is attached to this rotational frame, carries out parallel translation on said image formation face, and reads a projection picture, an inclination detecting means which detects inclination of a projection picture read with said line sensor, and inclination for which it asked.
Therefore, it is attained more, without a microfilm scanner provided with an inclination correction control means to amend.

[0008]
[Embodiment of the Invention]The figure in which drawing 1 shows the condition of use of 1 operation of this invention, the perspective view in which drawing 2 looked at the inside of this example through a fluoroscope, the side view in which drawing 3 shows arrangement of an important section, the perspective view in which drawing 4 shows a line sensor actuator, the block diagram which drawing 5 simplifies a control system and is shown, and drawing 6 are flow charts of operation.
[0009]In drawing 1, the numerals 10 are computer bodies and build in CPU etc. 12 is displays, such as CRT, 14 is a keyboard, and these are put on the desk 16. The scanner with which 18 was stored under this desk 16, and 20 are the printers placed beside the desk 16. The scanner 18 has the cartridge insertion opening 22 in the front top, and the picture of the microfilm 26 included in the cartridge 24 (drawing 2, three references) inserted here is read. After predetermined image processing is performed by CPU in the computer body 10, etc., the read picture is displayed on the display 12, and a print output is carried out to the printer 20, a memory is carried out to a magneto-optical disc etc., or it is transmitted to an external processor.

[0010]The scanner 18 has the longwise case 28, the supply-side-reels actuator 30 is allocated in the anterior part upper part in this case 28, and the rolling-up side reel drive part 32 is allocated in the anterior part lower part. When the cartridge 24 is inserted in the cartridge insertion opening 22, the supply-side-reels actuator 30 moves the cartridge 24 automatically, and makes the reel 24A engage with the axis of rotation. The head of the film 26 is pulled out, and it sends below, and leads to the machine reel 32A of the rolling-up side reel drive part 32.
[0011]The film 26 passes along the back side here, in view of the backside of the gap of each reel drive parts 30 and 32, i.e., before the case 28, as shown in drawing 2 and 3. 34, 34, 36, and 36 are the guide idlers of the film 26 in drawing 3. Therefore, the space 38 is formed between this gap and the front panel 28A of the case 28, and the after-mentioned light source part 52 is accommodated here.
[0012]The rolling-up side reel drive part 32 has the drive belt 40 it contacts and runs in the reel 32A, as shown in drawing 3. This drive belt 40 is wrapped around the guide idlers 42 and 44, the driving roller 46, the encoder 48, and the tension roller 50, and a running drive is carried out in the film rolling-up direction (arrow direction) by the driving roller 46.
[0013]52 is a light source part accommodated in the space 38 between said both reel drive parts 30 and 32.
It has the lamp 54, the reflector 56, the condenser lens 58, a proper filter, etc.
In drawing 2, 60 is a power circuit part and 62 is the power control circuit units, such as a motor.
[0014]Next, the line sensor actuator 64 is explained. The line sensor actuator 64 is united with the projection lens 66. That is, as shown in drawing 3 and 4, the cylinder part 70 holding the projection lens 66 is really formed in the frame (rotational frame) 68 of the line sensor actuator 64. The projection lens 66 held at this cylinder part 70 has twice [about] as many magnification as this by a fixed focus. The cylinder part 70 is held enabling free rotation on the frame (fixed frame) 72 fixed to the case 28. The cylinder part 70 rotates the optic axis 74 vertical to the film 26 as a center here.
[0015]The belt 78 is wrapped around the cylinder part 70 of the rotational frame 68, and the belt pulley 76A of the servo motor 76 attached to the fixed frame 72. And the rotational frame 68 is rotatable centering on the optic axis 74 by rotation of the motor 76.
[0016]it is shown in drawing 4 at the rotational frame 68 -- as -- a field opposite to the cylinder part 70 -- the movable base 80 -- attachment ********. That is, this movable base 80 is reciprocatable to the direction which is held slidably at the guide rods 82 and 82 of a couple, and intersects perpendicularly near the opening of the cylinder part 70 with the optic axis 74. The belt 86 almost wound around the belt pulleys 84 and 84 is formed in the both-way direction of the movable base 80, and parallel, and the 1 side of the movable base 80 is being fixed to the rotational frame 68 by this belt 86. Rotation of the servo motor 88 is told to one belt pulley 84 via the belt 90. The movable base 80 can be made to reciprocate by as a result right-reversing the servo motor 88 on the flat surface which intersects perpendicularly with the optic axis 74.
[0017]The long window is formed in the direction which intersects perpendicularly with the movable base 80 at the guide rods 82 and 82, i.e., the direction which intersects perpendicularly in the both-way direction of the movable base 80. As for this long window 92, the center of that length direction is located on the optic axis 74. It is being fixed to the rear face of this movable base 80, i.e., the field of the cylinder part 70 and an opposite hand, so that the optic axis 74 and the printed-circuit board 94 may cross at right angles.
[0018]CCD line sensor 96 which attends the long window 92 is being fixed to this substrate 94 (drawing 3). The preamplifier etc. which amplify the output of this line sensor 96 are carried in

this substrate 94. As for the acceptance surface of CCD line sensor 96, it is natural to make it in agreement with the image formation face of the projection picture of the projection lens 66.
[0019]CPU100 built in the computer body 10 has various functions as shown in drawing 5. Although these functions are formed by software, in drawing 5, a block shows these for convenience. The search control means 102 detects a target top using the blip for search (not shown) beforehand given to the film 26. That is, while counting the output of the blip sensor 104 made to approach the running route of the film 26, the motor 106 of the rolling-up side reel drive part 32 and the motor (not shown) of the supply-side-reels actuator 30 are controlled, and a target top is searched for.
[0020]If 108 goes into the prescribed position of the projection range where it is a scan control means and a target top includes the optic axis 74, it will operate the line sensor actuator 64. That is, the motor 88 is operated, parallel translation of the line sensor 66 is carried out on the image formation face of a picture, and a projection picture is read. The lamp 54 of the light source part 52 is made to turn on between this scan.
[0021]110 is a change-over switch, and it is connected to the A side of drawing 5 at the time of the 1st preliminary scan, and it is switched to the B side at the time of this 2nd scan. 112 is a black frame detection means, when the change-over switch 110 is connected to the A side, reads a picture signal with the scan of the line sensor 66, and detects a black frame.
[0022]This black frame is a portion which appears in the periphery of a manuscript picture at the time of the portion around a manuscript, i.e., a print. Various black-framed detection algorithms are proposed. For example, if it goes into a manuscript from a black frame when it scans, since it will change to the pixel of the white which the black pixel more than a fixed pixel number followed, the boundary of a black frame and a manuscript is detectable.
[0023]Thus, if a black frame is detected, the inclination detecting means 114 will ask for inclination of the picture of a manuscript next. The inclination correction means 116 drives the motor 76, in order to amend this inclination. As a result, the line sensor actuator 64 whole rotates, and the line sensor 66 is made one side and parallel of a projection picture.
[0024]118 is an image processing means, if the change-over switch 110 is connected to the B side and this scan is performed, will read the output of the line sensor 66 and will perform predetermined image processing. For example, image enhancement, picture inversion, zooming of a picture, spatial filtering processing, trimming, masking, etc. are processed.
[0025]Next, operation of this example is explained. If the cartridge 24 is inserted in the cartridge insertion opening 22 and the supply-side-reels actuator 30 is loaded with it, the head of the film 26 will be pulled out below. And the head of the film 26 is guided to the guide idlers 34 and 34, or 36 and 36 grades, and is led to the rolling-up side reel drive part 32. The head of the film 26 is inserted into the reel 32A and the drive belt 40, and is twisted around the reel 32A.
[0026]The blip for search is beforehand given to the film 26, and this blip is detected by the blip sensors 104 (drawing 5), such as a photo-transistor, during a run of the film 26 (Step 200 of drawing 6). The top of a retrieval target is distinguished by counting the blip of a search means 102 smell lever. If a target top comes, this top will be positioned in the projection range (frame) including the optic axis 74, and delivery of the film 26 will be stopped. And the image reading of this top starts next.
[0027]Since this first image reading is [for asking for inclination of a picture] preliminary, it is called a preliminary scan (Step 202). In this preliminary scan, the scan control means 108 puts the change-over switch 110 into the A side first, and turns on the lamp 54 of the light source part 52. Then, the picture of a top is expanded twice [about] with the projection lens 66, and is

projected on the movable base 80.
[0028]The movable base 80 is driven by the motor 88 so that the line sensor 96 may move the whole projection range of a projection picture toward another side from one side. The line sensor 96 reads the projection picture on an image formation face in the meantime. Thus, while the scan (preliminary scan) by the line sensor 96 is performed, the output of the line sensor 96 is amplified by the preamplifier on a substrate, and is sent to the computer body 10.
[0029]It asks for the black frame of the manuscript contained in the projection picture by the black frame detection means 112 in CPU100 (Step 204). And the inclination detecting means 114 asks for inclination of a picture by this black frame (Step 206). It can ask for this inclination by detecting the black frame used as the periphery of the picture of a manuscript. If inclination of a picture is called for, the rotational frame 68 will be rotated with the servo motor 88, and inclination will be set to 0. That is, the longitudinal direction of the line sensor 96 is coincided with one side of a black frame (Step 208).
[0030]The above scan operation is [for coinciding inclination by the picture and the line sensor 96] preliminary.
This scan which reads an original picture after this preliminary scan is performed (Step 210). The line sensor 96 reads a picture again, image processing of this output is carried out by the image processing means 118 (Step 212), and the print output of that result is carried out to the printer 120 (Step 214). The memory of this result is carried out to external memory devices, such as a magneto-optical disc, or it outputs to other image processing devices.
[0031]If it is after finishing this scan and carrying out the memory of the picture signal to CPU100 when searching many tops continuously, search of the following top can be started promptly. After finishing this scan at this time, it is desirable to return inclination correction to the original state (Step 216 of drawing 6). Thus, inclination is returned to the original state because the state where a picture separates from this scan range and it becomes impossible to detect a black frame correctly may occur, if it leans to the opposite direction greatly to the top of a film, the scan range, i.e., the direct reading, of the line sensor 66.
[0032]In a microfilm, since arrangement of the light source part 52 and the projection lens 66 is usually contrary to this example, when the microfilm used for such a conventional device is used by this example, a projection picture turns into a picture which back-****(ed). In this case, what is necessary is just to change into a right image electrically by image processing, and such processing is easy.
[0033]Although the rotation center axis of the line sensor actuator 64 is coincided with the optic axis 74 in the above example, it is not necessary to coincide these. Usually, it is since the picture of a manuscript is copied by 1 side slippage of projection within the limits. The picture of a manuscript is able to lessen a possibility of separating from the scan range of a line sensor by making this 1 side slippage bias the rotation center axis of the line sensor actuator 64. Drawing 7 - 9 explain the principle.
[0034]Drawing 7 corresponds to drawing 3 and the example described by 4, and shows the case where scan range S is rotated centering on the optic axis 74. S_0 is a scan range to the film 26 when not performing inclination correction to the film 26 in this figure. S_1 is the scan range rotated about 20 degrees to the counterclockwise rotation centering on the optic axis 74.
[0035]If about 20 degrees of tops 26A of the manuscript photoed by the film 26 now lean to the counterclockwise rotation, based on the detected black frame, the line sensor actuator 64 will rotate and only the degree of isogonism will change scan range S_0 to S_1. At this time, it may separate from scan range S_1 with a new field near the corner of scan range S_0 of origin. It is a

range it becomes impossible to read the shadow area of deltaABC within the limits among the tops 26A by drawing 7. This range it becomes impossible to read increases as the amount of inclination correction increases. The inside 26B of a figure is a blip, and is detected by said blip sensor 104 (drawing 5).

[0036]Drawing 8 shows the case where scan range S_0 is rotated to a counterclockwise rotation focusing on the center D of the left side of scan range S_0. S_2 is a new scan range. Other conditions are the same as the case of drawing 7. Generally, since the top 26A is brought near by the 1 side of the projection range and is copied, it puts the rotational center D on the neighborhood of this top 26A slippage. Thus, in order that the rotational center may approach the top 26A, it is lost that the top 26A separates from the scan range after inclination correction.

[0037]Drawing 9 shows the case where one top is photoed one by one in the length direction of the film 26 at each 1/2 piece of the film 26. There are a duo method and a duplex method as such a technique. A duo method classifies a film into A channel of every 1/2 piece, and B channel, and if one top carries out single-sided photography at a time one by one and photography of A channel finishes with A channel, it will photo sequential from an opposite direction to B channel. A film width direction makes the table and the reverse side of a manuscript adjoin simultaneously, and a duplex method photos them.

[0038]When the top 26C (drawing 9) is photoed in 1/2 piece of a film like these methods, the interval L of the top 26C and scan range S_0 (drawing 9) becomes small. For this reason, as for the center of rotation of inclination correction, it is more desirable than the center D of the neighborhood of top 26C slippage of scan range S_0 to make it the point E shifted to the top 26C side distance X. This distance X should be determined in consideration of the degree of maximum angle of inclination correction, and the interval L and the position of the top 26C. S_3 is a scan range after inclination correction in drawing 9.

[0039]Next, the example to which eccentricity of the center (D or E) of inclination correction was carried out from the optic axis 74 in this way is described using drawing 10 and 11. Drawing 10 is the front view which the side view and drawing 11 which carried out the section of a part of this example excluded the substrate 94 and the line sensor 96 in drawing 10, and was seen from right-hand side. In these drawing 10 and 11, since identical codes were given to said drawing 3, and 4 and a corresponding portion, the explanation is not repeated.

[0040]The internal cylinder part 72B protrudes on the fixed frame 72A in drawing 10 and 11, and eccentricity of the center (center of rotation) 72C of this internal cylinder part 72B is carried out to the optic axis 74 of the projection lens 66. The outer tube section 70A held via the radial bearing 68B and the thrust block 68C at the outside of this internal cylinder part 72B is formed in the rotational frame 68A. This outer tube section 70A rotates by the motor 76 via the belt 78.

[0041]The pin 70B (one is illustrated) of 37 protrudes on the peripheral face of the outer tube section 68B to a radial direction at equal intervals, and these pins 70B are pressed down by the ferrule 70D via the bearing 70C by this rotational frame 68A. As a result, the outer tube section 70A and the rotational frame 68A are held to the fixed frame 72A side.

[0042]The motor 88A for making the line sensor 96 scan is attached to the upper part of the rotational frame 68A, and the rotation is told to the middle pulley 88C via the belt 88B, and is further told to other middle pulleys 88E by the belt 88D. Rotation of the motor 88A is slowed down by these middle pulleys 88B and 88D, and makes the belt 86A with which the movable base 80 was fixed reciprocate. S_{00} shows the scan range of the line sensor 96 by drawing 11.

[0043]According to this example, the rotational frame 68A rotates by rotation of the motor 76 focusing on the center 72C of the outer tube section 70A and the internal cylinder part 72B. As it

explained in said drawing 8 and 9 as a result, eccentricity of the center of inclination correction can be carried out from the optic axis 74.
[0044]After the projection lens 66 has separated from the film 26, it is shown in drawing 3, but the tip of a projection lens may be made to extend to the film side, and the clear glass board which positions a film may be made to contact slidably. If it does in this way, the relative positioning accuracy of a film and a projection lens will improve. Since this projection lens is held at the rotational frame 68 of the line sensor actuator, it can make high relative-position arrangement accuracy of a film, a projection lens, and a line sensor running surface after all. Therefore, even if it uses the projection lens of a fixed focus and low magnification, highly precise image reading becomes possible.
[0045]
[Effect of the Invention]The invention of claim 1 allocated the projection lens between image formation faces parallel to a film as mentioned above, carried out parallel translation of the line sensor on the image formation face, read the picture, and rotates the scan range of a line sensor and was made to perform inclination correction of the projection picture. For this reason, an optical system can be miniaturized without using a reflector and an image rotating prism, and the miniaturization of the whole device is attained.
[0046]Although the rotational frame which holds a line sensor here may be rotated centering on the optic axis of an optical system (projection lens), when biasing to the 1 side as which it is projection within the limits, and the position of the top was decided beforehand, it is desirable to make the center of a rotational frame bias to this bias side. The picture of a top can be prevented from separating from the scan range of a line sensor at the time of inclination correction if it does in this way (claim 2).

TECHNICAL FIELD

[Industrial Application]This invention relates to the microfilm scanner which reads the picture of a microfilm using a line sensor.

PRIOR ART

[Description of the Prior Art]The microfilm scanner which read the picture of the microfilm using image sensors, such as a line sensor, is proposed. Thus, by reading a picture with an image sensor, image processing is performed as a digital image signal, and it becomes easy to output to a printer, to carry out a memory to a magneto-optical disc etc., or to transmit to other image processing devices.
[0003]Extended projection of the projection picture of a film is greatly carried out to a screen, using a reflector as such a device, and there are some which read this expanded picture with a CCD line sensor.
[0004]In this case, if the picture photoed by the microfilm leans, the picture leaning also to the screen will be projected. Then, while an operator looks at a screen, after correcting inclination of a picture, the picture is read with the line sensor. Inclination correction of this picture was made by making an image rotating prism placed between optical systems, and rotating this prism with a servo motor.

EFFECT OF THE INVENTION

[Effect of the Invention]The invention of claim 1 allocated the projection lens between image formation faces parallel to a film as mentioned above, carried out parallel translation of the line sensor on the image formation face, read the picture, and rotates the scan range of a line sensor and was made to perform inclination correction of the projection picture. For this reason, an optical system can be miniaturized without using a reflector and an image rotating prism, and the miniaturization of the whole device is attained.
[0046]Although the rotational frame which holds a line sensor here may be rotated centering on the optic axis of an optical system (projection lens), when biasing to the 1 side as which it is projection within the limits, and the position of the top was decided beforehand, it is desirable to make the center of a rotational frame bias to this bias side. The picture of a top can be prevented from separating from the scan range of a line sensor at the time of inclination correction if it does in this way (claim 2).

TECHNICAL PROBLEM

[Description of the Prior Art]Thus, with the conventional device, since the projection picture was expanded using two or more reflectors, there was a problem that a device was enlarged. If an image rotating prism is a big optical system in this way, it is also possible to also secure receiving space, but there are problems, like when an optical system is made small, it becomes impossible to secure the receiving space, and the miniaturization of a device becomes difficult.
[0006]
[Objects of the Invention]This invention is made in view of such a situation, inclination correction of a picture can be made, without using an image rotating prism, and it aims at providing a micro scanner suitable for the miniaturization of the whole device, especially the miniaturization of an optical system.
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[Elements of the Invention]In a microfilm scanner which reads a picture of a microfilm which stored this purpose to a cartridge in this invention using a line sensor, A projection lens of a fixed focus allocated between a microfilm and an image formation face so that image formation of the projection picture might be carried out on an image formation face parallel to a microfilm, A rotational frame held pivotable on a fixed frame to which said projection lens is attached at a circumference of an axis parallel to an optic axis of said projection lens, Said rotational frame is rotated for a line sensor which is attached to this rotational frame, carries out parallel translation on said image formation face, and reads a projection picture, an inclination detecting means which detects inclination of a projection picture read with said line sensor, and inclination for which it asked.
Therefore, it is attained more, without a microfilm scanner provided with an inclination correction control means to amend.

[0008]
[Embodiment of the Invention]The figure in which drawing 1 shows the condition of use of 1 operation of this invention, the perspective view in which drawing 2 looked at the inside of this example through a fluoroscope, the side view in which drawing 3 shows arrangement of an important section, the perspective view in which drawing 4 shows a line sensor actuator, the block diagram which drawing 5 simplifies a control system and is shown, and drawing 6 are flow charts of operation.
[0009]In drawing 1, the numerals 10 are computer bodies and build in CPU etc. 12 is displays,

such as CRT, 14 is a keyboard, and these are put on the desk 16. The scanner with which 18 was stored under this desk 16, and 20 are the printers placed beside the desk 16. The scanner 18 has the cartridge insertion opening 22 in the front top, and the picture of the microfilm 26 included in the cartridge 24 (drawing 2, three references) inserted here is read. After predetermined image processing is performed by CPU in the computer body 10, etc., the read picture is displayed on the display 12, and a print output is carried out to the printer 20, a memory is carried out to a magneto-optical disc etc., or it is transmitted to an external processor.

[0010]The scanner 18 has the longwise case 28, the supply-side-reels actuator 30 is allocated in the anterior part upper part in this case 28, and the rolling-up side reel drive part 32 is allocated in the anterior part lower part. When the cartridge 24 is inserted in the cartridge insertion opening 22, the supply-side-reels actuator 30 moves the cartridge 24 automatically, and makes the reel 24A engage with the axis of rotation. The head of the film 26 is pulled out, and it sends below, and leads to the machine reel 32A of the rolling-up side reel drive part 32.

[0011]The film 26 passes along the back side here, in view of the backside of the gap of each reel drive parts 30 and 32, i.e., before the case 28, as shown in drawing 2 and 3. 34, 34, 36, and 36 are the guide idlers of the film 26 in drawing 3. Therefore, the space 38 is formed between this gap and the front panel 28A of the case 28, and the after-mentioned light source part 52 is accommodated here.

[0012]The rolling-up side reel drive part 32 has the drive belt 40 it contacts and runs in the reel 32A, as shown in drawing 3. This drive belt 40 is wrapped around the guide idlers 42 and 44, the driving roller 46, the encoder 48, and the tension roller 50, and a running drive is carried out in the film rolling-up direction (arrow direction) by the driving roller 46.

[0013]52 is a light source part accommodated in the space 38 between said both reel drive parts 30 and 32.

It has the lamp 54, the reflector 56, the condenser lens 58, a proper filter, etc.

In drawing 2, 60 is a power circuit part and 62 is the power control circuit units, such as a motor.

[0014]Next, the line sensor actuator 64 is explained. The line sensor actuator 64 is united with the projection lens 66. That is, as shown in drawing 3 and 4, the cylinder part 70 holding the projection lens 66 is really formed in the frame (rotational frame) 68 of the line sensor actuator 64. The projection lens 66 held at this cylinder part 70 has twice [about] as many magnification as this by a fixed focus. The cylinder part 70 is held enabling free rotation on the frame (fixed frame) 72 fixed to the case 28. The cylinder part 70 rotates the optic axis 74 vertical to the film 26 as a center here.

[0015]The belt 78 is wrapped around the cylinder part 70 of the rotational frame 68, and the belt pulley 76A of the servo motor 76 attached to the fixed frame 72. And the rotational frame 68 is rotatable centering on the optic axis 74 by rotation of the motor 76.

[0016]it is shown in drawing 4 at the rotational frame 68 -- as -- a field opposite to the cylinder part 70 -- the movable base 80 -- attachment ********. That is, this movable base 80 is reciprocatable to the direction which is held slidably at the guide rods 82 and 82 of a couple, and intersects perpendicularly near the opening of the cylinder part 70 with the optic axis 74. The belt 86 almost wound around the belt pulleys 84 and 84 is formed in the both-way direction of the movable base 80, and parallel, and the 1 side of the movable base 80 is being fixed to the rotational frame 68 by this belt 86. Rotation of the servo motor 88 is told to one belt pulley 84 via the belt 90. The movable base 80 can be made to reciprocate by as a result right-reversing the servo motor 88 on the flat surface which intersects perpendicularly with the optic axis 74.

[0017]The long window is formed in the direction which intersects perpendicularly with the

movable base 80 at the guide rods 82 and 82, i.e., the direction which intersects perpendicularly in the both-way direction of the movable base 80. As for this long window 92, the center of that length direction is located on the optic axis 74. It is being fixed to the rear face of this movable base 80, i.e., the field of the cylinder part 70 and an opposite hand, so that the optic axis 74 and the printed-circuit board 94 may cross at right angles.

[0018]CCD line sensor 96 which attends the long window 92 is being fixed to this substrate 94 (drawing 3). The preamplifier etc. which amplify the output of this line sensor 96 are carried in this substrate 94. As for the acceptance surface of CCD line sensor 96, it is natural to make it in agreement with the image formation face of the projection picture of the projection lens 66.

[0019]CPU100 built in the computer body 10 has various functions as shown in drawing 5. Although these functions are formed by software, in drawing 5, a block shows these for convenience. The search control means 102 detects a target top using the blip for search (not shown) beforehand given to the film 26. That is, while counting the output of the blip sensor 104 made to approach the running route of the film 26, the motor 106 of the rolling-up side reel drive part 32 and the motor (not shown) of the supply-side-reels actuator 30 are controlled, and a target top is searched for.

[0020]If 108 goes into the prescribed position of the projection range where it is a scan control means and a target top includes the optic axis 74, it will operate the line sensor actuator 64. That is, the motor 88 is operated, parallel translation of the line sensor 66 is carried out on the image formation face of a picture, and a projection picture is read. The lamp 54 of the light source part 52 is made to turn on between this scan.

[0021]110 is a change-over switch, and it is connected to the A side of drawing 5 at the time of the 1st preliminary scan, and it is switched to the B side at the time of this 2nd scan. 112 is a black frame detection means, when the change-over switch 110 is connected to the A side, reads a picture signal with the scan of the line sensor 66, and detects a black frame.

[0022]This black frame is a portion which appears in the periphery of a manuscript picture at the time of the portion around a manuscript, i.e., a print. Various black-framed detection algorithms are proposed. For example, if it goes into a manuscript from a black frame when it scans, since it will change to the pixel of the white which the black pixel more than a fixed pixel number followed, the boundary of a black frame and a manuscript is detectable.

[0023]Thus, if a black frame is detected, the inclination detecting means 114 will ask for inclination of the picture of a manuscript next. The inclination correction means 116 drives the motor 76, in order to amend this inclination. As a result, the line sensor actuator 64 whole rotates, and the line sensor 66 is made one side and parallel of a projection picture.

[0024]118 is an image processing means, if the change-over switch 110 is connected to the B side and this scan is performed, will read the output of the line sensor 66 and will perform predetermined image processing. For example, image enhancement, picture inversion, zooming of a picture, spatial filtering processing, trimming, masking, etc. are processed.

[0025]Next, operation of this example is explained. If the cartridge 24 is inserted in the cartridge insertion opening 22 and the supply-side-reels actuator 30 is loaded with it, the head of the film 26 will be pulled out below. And the head of the film 26 is guided to the guide idlers 34 and 34, or 36 and 36 grades, and is led to the rolling-up side reel drive part 32. The head of the film 26 is inserted into the reel 32A and the drive belt 40, and is twisted around the reel 32A.

[0026]The blip for search is beforehand given to the film 26, and this blip is detected by the blip sensors 104 (drawing 5), such as a photo-transistor, during a run of the film 26 (Step 200 of drawing 6). The top of a retrieval target is distinguished by counting the blip of a search means

102 smell lever. If a target top comes, this top will be positioned in the projection range (frame) including the optic axis 74, and delivery of the film 26 will be stopped. And the image reading of this top starts next.

[0027]Since this first image reading is [for asking for inclination of a picture] preliminary, it is called a preliminary scan (Step 202). In this preliminary scan, the scan control means 108 puts the change-over switch 110 into the A side first, and turns on the lamp 54 of the light source part 52. Then, the picture of a top is expanded twice [about] with the projection lens 66, and is projected on the movable base 80.

[0028]The movable base 80 is driven by the motor 88 so that the line sensor 96 may move the whole projection range of a projection picture toward another side from one side. The line sensor 96 reads the projection picture on an image formation face in the meantime. Thus, while the scan (preliminary scan) by the line sensor 96 is performed, the output of the line sensor 96 is amplified by the preamplifier on a substrate, and is sent to the computer body 10.

[0029]It asks for the black frame of the manuscript contained in the projection picture by the black frame detection means 112 in CPU100 (Step 204). And the inclination detecting means 114 asks for inclination of a picture by this black frame (Step 206). It can ask for this inclination by detecting the black frame used as the periphery of the picture of a manuscript. If inclination of a picture is called for, the rotational frame 68 will be rotated with the servo motor 88, and inclination will be set to 0. That is, the longitudinal direction of the line sensor 96 is coincided with one side of a black frame (Step 208).

[0030]The above scan operation is [for coinciding inclination by the picture and the line sensor 96] preliminary.

This scan which reads an original picture after this preliminary scan is performed (Step 210). The line sensor 96 reads a picture again, image processing of this output is carried out by the image processing means 118 (Step 212), and the print output of that result is carried out to the printer 120 (Step 214). The memory of this result is carried out to external memory devices, such as a magneto-optical disc, or it outputs to other image processing devices.

[0031]If it is after finishing this scan and carrying out the memory of the picture signal to CPU100 when searching many tops continuously, search of the following top can be started promptly. After finishing this scan at this time, it is desirable to return inclination correction to the original state (Step 216 of drawing 6). Thus, inclination is returned to the original state because the state where a picture separates from this scan range and it becomes impossible to detect a black frame correctly may occur, if it leans to the opposite direction greatly to the top of a film, the scan range, i.e., the direct reading, of the line sensor 66.

[0032]In a microfilm, since arrangement of the light source part 52 and the projection lens 66 is usually contrary to this example, when the microfilm used for such a conventional device is used by this example, a projection picture turns into a picture which back-****(ed). In this case, what is necessary is just to change into a right image electrically by image processing, and such processing is easy.

[0033]Although the rotation center axis of the line sensor actuator 64 is coincided with the optic axis 74 in the above example, it is not necessary to coincide these. Usually, it is since the picture of a manuscript is copied by 1 side slippage of projection within the limits. The picture of a manuscript is able to lessen a possibility of separating from the scan range of a line sensor by making this 1 side slippage bias the rotation center axis of the line sensor actuator 64. Drawing 7 - 9 explain the principle.

[0034]Drawing 7 corresponds to drawing 3 and the example described by 4, and shows the case

where scan range S is rotated centering on the optic axis 74. S_0 is a scan range to the film 26 when not performing inclination correction to the film 26 in this figure. S_1 is the scan range rotated about 20 degrees to the counterclockwise rotation centering on the optic axis 74.
[0035]If about 20 degrees of tops 26A of the manuscript photoed by the film 26 now lean to the counterclockwise rotation, based on the detected black frame, the line sensor actuator 64 will rotate and only the degree of isogonism will change scan range S_0 to S_1. At this time, it may separate from scan range S_1 with a new field near the corner of scan range S_0 of origin. It is a range it becomes impossible to read the shadow area of deltaABC within the limits among the tops 26A by drawing 7. This range it becomes impossible to read increases as the amount of inclination correction increases. The inside 26B of a figure is a blip, and is detected by said blip sensor 104 (drawing 5).
[0036]Drawing 8 shows the case where scan range S_0 is rotated to a counterclockwise rotation focusing on the center D of the left side of scan range S_0. S_2 is a new scan range. Other conditions are the same as the case of drawing 7. Generally, since the top 26A is brought near by the 1 side of the projection range and is copied, it puts the rotational center D on the neighborhood of this top 26A slippage. Thus, in order that the rotational center may approach the top 26A, it is lost that the top 26A separates from the scan range after inclination correction.
[0037]Drawing 9 shows the case where one top is photoed one by one in the length direction of the film 26 at each 1/2 piece of the film 26. There are a duo method and a duplex method as such a technique. A duo method classifies a film into A channel of every 1/2 piece, and B channel, and if one top carries out single-sided photography at a time one by one and photography of A channel finishes with A channel, it will photo sequential from an opposite direction to B channel. A film width direction makes the table and the reverse side of a manuscript adjoin simultaneously, and a duplex method photos them.
[0038]When the top 26C (drawing 9) is photoed in 1/2 piece of a film like these methods, the interval L of the top 26C and scan range S_0 (drawing 9) becomes small. For this reason, as for the center of rotation of inclination correction, it is more desirable than the center D of the neighborhood of top 26C slippage of scan range S_0 to make it the point E shifted to the top 26C side distance X. This distance X should be determined in consideration of the degree of maximum angle of inclination correction, and the interval L and the position of the top 26C. S_3 is a scan range after inclination correction in drawing 9.
[0039]Next, the example to which eccentricity of the center (D or E) of inclination correction was carried out from the optic axis 74 in this way is described using drawing 10 and 11. Drawing 10 is the front view which the side view and drawing 11 which carried out the section of a part of this example excluded the substrate 94 and the line sensor 96 in drawing 10, and was seen from right-hand side. In these drawing 10 and 11, since identical codes were given to said drawing 3, and 4 and a corresponding portion, the explanation is not repeated.
[0040]The internal cylinder part 72B protrudes on the fixed frame 72A in drawing 10 and 11, and eccentricity of the center (center of rotation) 72C of this internal cylinder part 72B is carried out to the optic axis 74 of the projection lens 66. The outer tube section 70A held via the radial bearing 68B and the thrust block 68C at the outside of this internal cylinder part 72B is formed in the rotational frame 68A. This outer tube section 70A rotates by the motor 76 via the belt 78.
[0041]The pin 70B (one is illustrated) of 37 protrudes on the peripheral face of the outer tube section 68B to a radial direction at equal intervals, and these pins 70B are pressed down by the ferrule 70D via the bearing 70C by this rotational frame 68A. As a result, the outer tube section 70A and the rotational frame 68A are held to the fixed frame 72A side.

[0042]The motor 88A for making the line sensor 96 scan is attached to the upper part of the rotational frame 68A, and the rotation is told to the middle pulley 88C via the belt 88B, and is further told to other middle pulleys 88E by the belt 88D. Rotation of the motor 88A is slowed down by these middle pulleys 88B and 88D, and makes the belt 86A with which the movable base 80 was fixed reciprocate. S_{00} shows the scan range of the line sensor 96 by drawing 11.
[0043]According to this example, the rotational frame 68A rotates by rotation of the motor 76 focusing on the center 72C of the outer tube section 70A and the internal cylinder part 72B. As it explained in said drawing 8 and 9 as a result, eccentricity of the center of inclination correction can be carried out from the optic axis 74.
[0044]After the projection lens 66 has separated from the film 26, it is shown in drawing 3, but the tip of a projection lens may be made to extend to the film side, and the clear glass board which positions a film may be made to contact slidably. If it does in this way, the relative positioning accuracy of a film and a projection lens will improve. Since this projection lens is held at the rotational frame 68 of the line sensor actuator, it can make high relative-position arrangement accuracy of a film, a projection lens, and a line sensor running surface after all. Therefore, even if it uses the projection lens of a fixed focus and low magnification, highly precise image reading becomes possible.

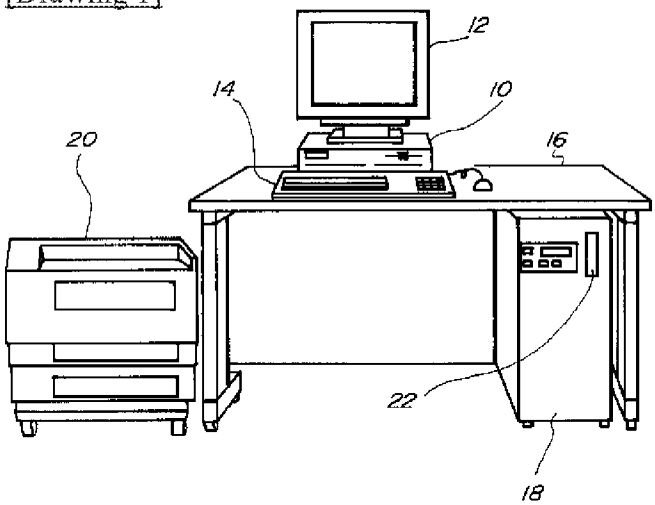
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The figure showing the condition of use of one example of this invention
[Drawing 2]The fluoroscopy perspective view of this example
[Drawing 3]Similarly it is a side view of an important section.
[Drawing 4]The perspective view showing a line sensor actuator
[Drawing 5]The block diagram showing a control system
[Drawing 6]A flow chart of operation
[Drawing 7]The explanatory view of inclination correction
[Drawing 8]The explanatory view of inclination correction
[Drawing 9]The explanatory view of inclination correction
[Drawing 10]The side view of other examples
[Drawing 11]Similarly it is a front view.
[Description of Notations]
10 Computer body
12 Display
18 Scanner
20 Printer
22 Cartridge insertion opening
24 Cartridge
26 Microfilm
30 Supply-side-reels actuator
32 Rolling-up side reel drive part
52 Light source part
64 Line sensor actuator
66 Projection lens

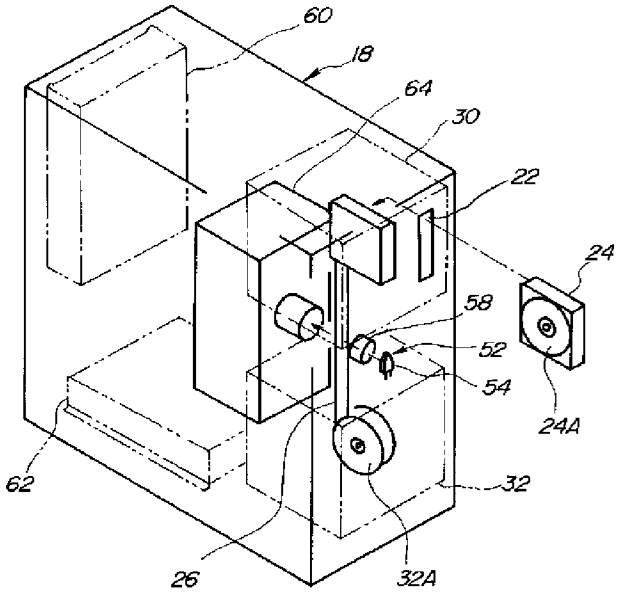
68 and 68A rotational frame
72 72A Fixed frame
72C Center of rotation
74 Optic axis
80 Movable base
92 Long window
94 Substrate
96 CCD line sensor
100 CPU
114 Inclination detecting means
116 Inclination correction control means

DRAWINGS

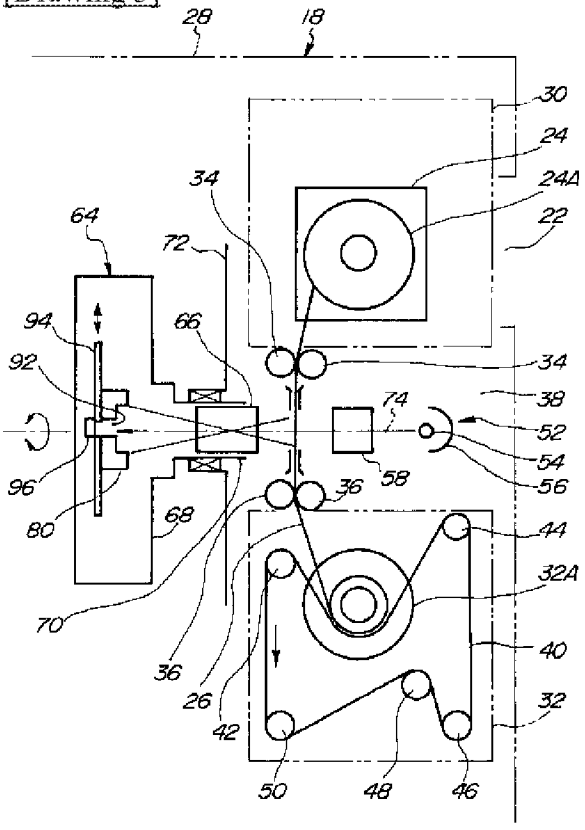
[Drawing 1]



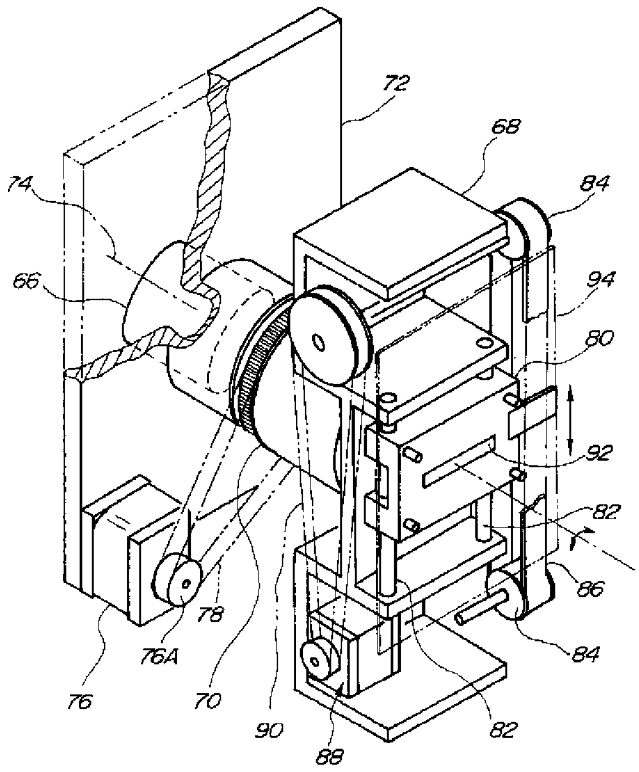
[Drawing 2]



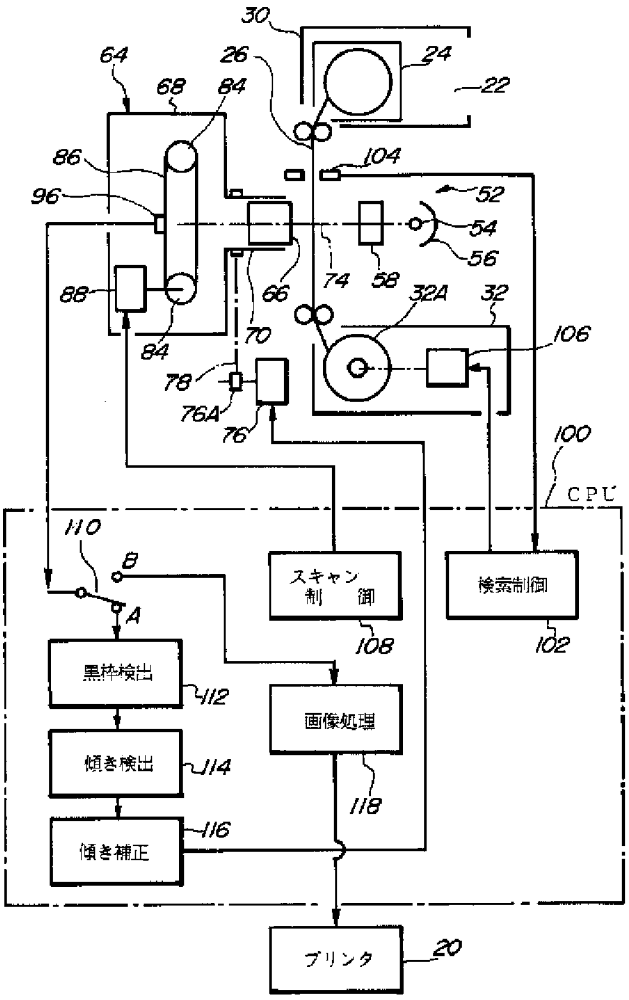
[Drawing 3]



[Drawing 4]



[Drawing 5]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74
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66
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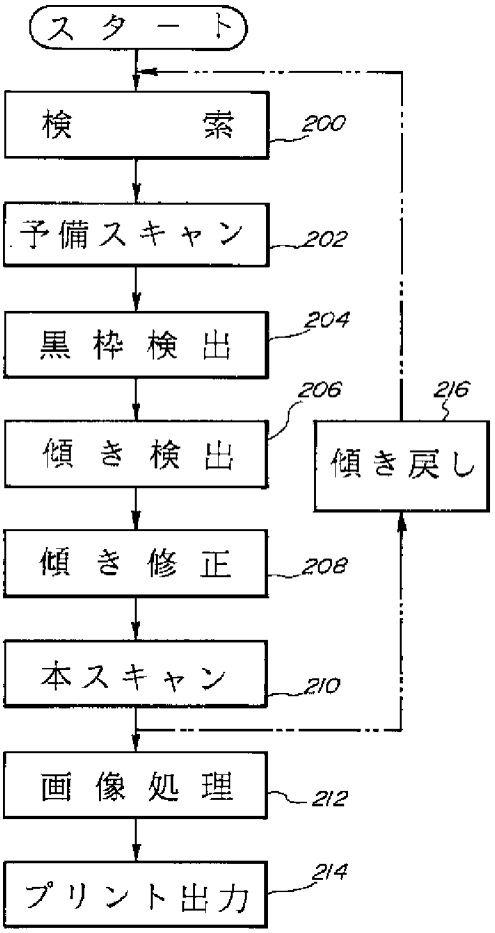
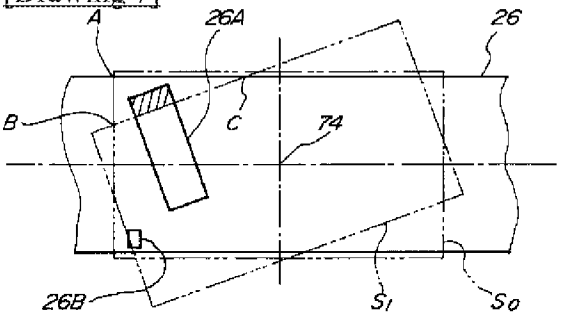
32A
32
106
84
70
78
76A
76
100
CPU
110
B
A
スキャン制御
検索制御
108
102
黒枠検出
112
画像処理
傾き検出
114
118
傾き補正
116
プリンタ
20

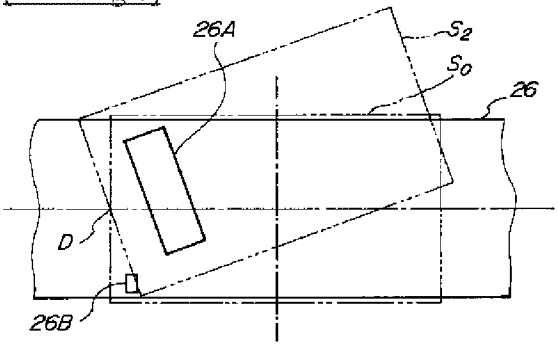
[Drawing 6]



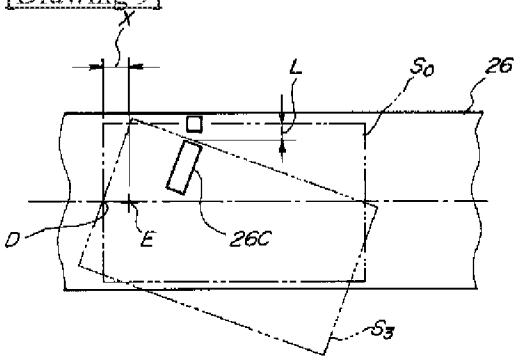
[Drawing 7]



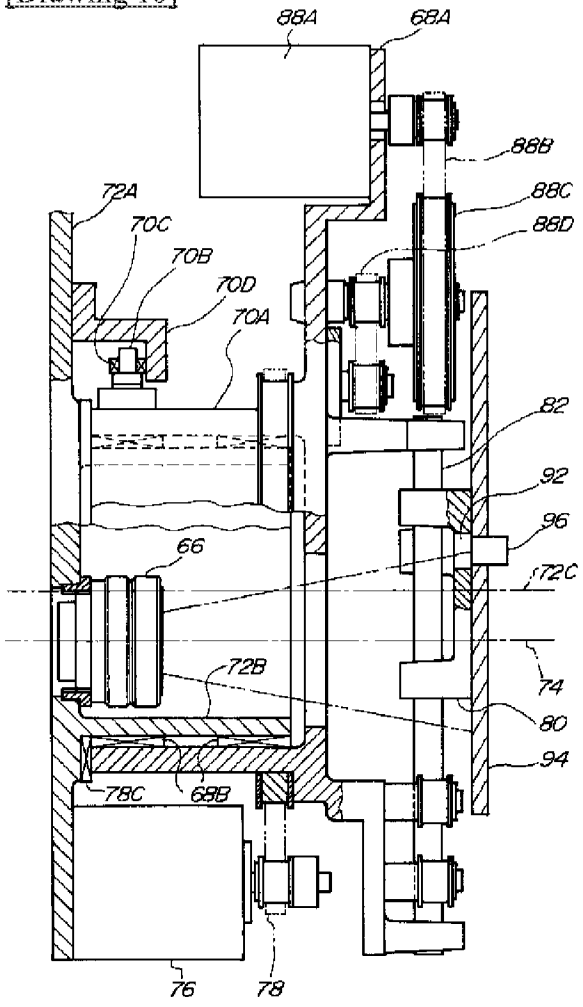
[Drawing 8]



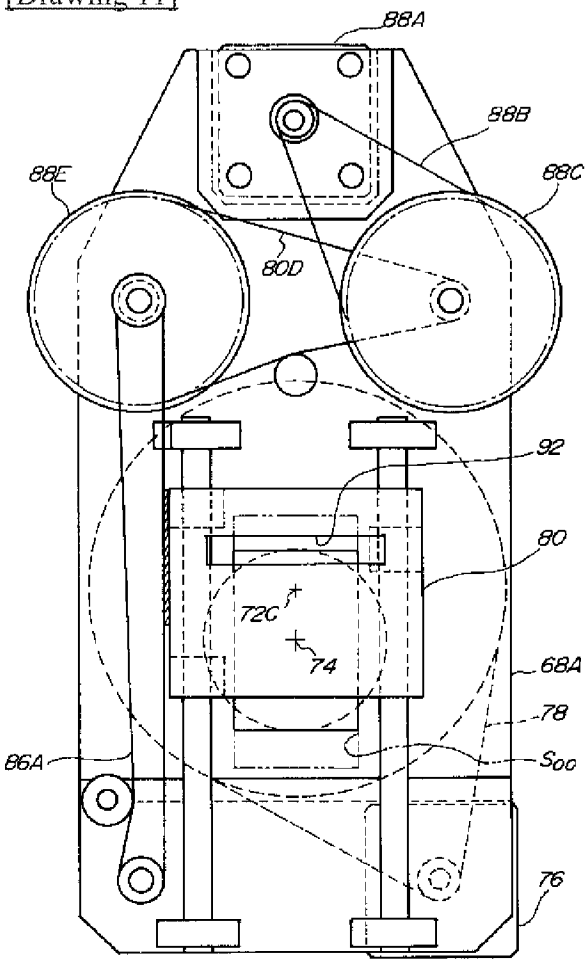
[Drawing 9]



[Drawing 10]



[Drawing 11]



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Inventor(s): Hiroshi Takabayashi
Applicant(s): Fuji Photographic Film K.K.
Attorney(s): Fumio Yamada et al.

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1. Title of the Invention

MICROFILM SCANNER

2. Claims

(omitted)

3. Detailed Description of the Invention (Selected Portions)

1)

(omitted)

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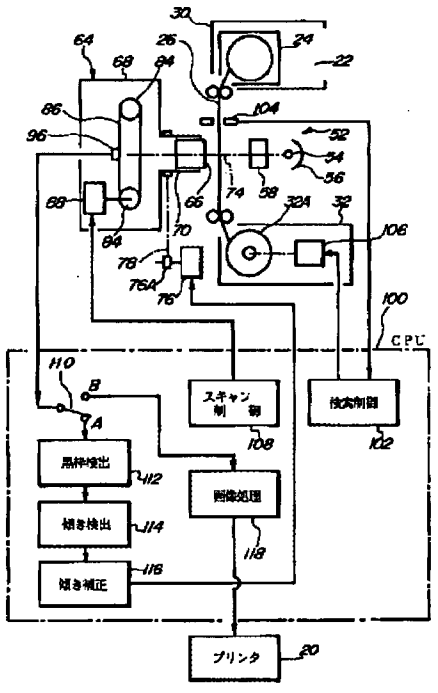
(54)【発明の名称】　マイクロフィルムスキャナ

(57)【要約】

【目的】　カートリッジに収納したマイクロフィルムの画像をラインセンサを用いて読取るマイクロフィルムスキャナにおいて、像回転プリズムを用いることなく画像の傾き修正を行うことができ、装置全体の小型化特に光学系の小型化を可能にする。

【構成】　投影画像をマイクロフィルムと平行な結像面上に結像するようにマイクロフィルムと結像面との間に配設された固定焦点の投影レンズと、投影レンズが取付けられる固定フレームに投影レンズの光軸と平行な軸回りに回転可能に保持された回転フレームと、この回転フレームに取付けられ結像面上で平行移動して投影画像を読取るラインセンサと、ラインセンサで読取った投影画像の傾きを検出する傾き検出手段と、求めた傾きを回転フレームを回転させることにより補正する傾き補正制御手段とを備える。



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【特許請求の範囲】

【請求項１】　マイクロフィルムの画像をラインセンサを用いて読取るマイクロフィルムスキャナにおいて、投影画像をマイクロフィルムと平行な結像面上に結像するようにマイクロフィルムと結像面との間に配設された固定焦点の投影レンズと、前記投影レンズが取付けられる固定フレームに前記投影レンズの光軸と平行な軸回りに回転可能に保持された回転フレームと、この回転フレームに取付けられ前記結像面上で平行移動して投影画像を読取るラインセンサと、前記ラインセンサで読取った投影画像の傾きを検出する傾き検出手段と、求めた傾きを前記回転フレームを回転させることにより補正する傾き補正制御手段とを備えることを特徴とするマイクロフィルムスキャナ。

【請求項２】　回転フレームは、投影レンズの光軸と平行でかつフィルム投影範囲内の原稿画像がある位置側に偏位した軸を中心にして回転可能である請求項１のマイクロフィルムスキャナ。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、マイクロフィルムの画像をラインセンサを用いて読取るマイクロフィルムスキャナに関するものである。

【０００２】

【従来の技術】マイクロフィルムの画像をラインセンサなどのイメージセンサを用いて読取るようにしたマイクロフィルムスキャナが提案されている。このように画像をイメージセンサで読取ることにより、デジタル画像信号として画像処理を行い、プリンタに出力したり、光磁気ディスクなどにメモリしたり、他の画像処理装置へ転送したりすることが容易になる。

【０００３】このような装置として、フィルムの投影画像を反射鏡を用いてスクリーンに大きく拡大投影し、ＣＣＤラインセンサによりこの拡大された画像を読取るものがある。

【０００４】この場合にマイクロフィルムに撮影された画像が傾いていると、スクリーンにも傾いた画像が投影される。そこで操作者がスクリーンを見ながら画像の傾きを修正してからラインセンサで画像を読取っている。この画像の傾き修正は、光学系に像回転プリズムを介在させ、このプリズムをサーボモータにより回転させることにより行われていた。

【０００５】

【従来技術の問題点】このように従来の装置では投影画像を複数の反射鏡を用いて拡大しているため装置が大型化するという問題があった。また像回転プリズムはこのように大きな光学系であれば収容空間も確保することも可能であるが、光学系を小さくした場合にはその収容空間を確保できなくなったり、装置の小型化が困難になる、等の問題がある。

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【０００６】

【発明の目的】本発明はこのような事情に鑑みなされたものであり、像回転プリズムを用いることなく画像の傾き修正を行うことができ、装置全体の小型化特に光学系の小型化に適するマイクロスキャナを提供することを目的とする。

【０００７】

【発明の構成】本発明によればこの目的は、カートリッジに収納したマイクロフィルムの画像をラインセンサを用いて読取るマイクロフィルムスキャナにおいて、投影画像をマイクロフィルムと平行な結像面上に結像するようにマイクロフィルムと結像面との間に配設された固定焦点の投影レンズと、前記投影レンズが取付けられる固定フレームに前記投影レンズの光軸と平行な軸回りに回転可能に保持された回転フレームと、この回転フレームに取付けられ前記結像面上で平行移動して投影画像を読取るラインセンサと、前記ラインセンサで読取った投影画像の傾きを検出する傾き検出手段と、求めた傾きを前記回転フレームを回転させることにより補正する傾き補正制御手段とを備えることを特徴とするマイクロフィルムスキャナ、により達成される。

【０００８】

【実施態様】図１は本発明の一実施の使用状態を示す図、図２はこの実施例の内部を透視した斜視図、図３は要部の配置を示す側面図、図４はラインセンサ駆動部を示す斜視図、図５は制御系統を簡略化して示すブロック図、図６は動作流れ図である。

【０００９】図１において符号１０はコンピュータ本体であり、ＣＰＵなどを内蔵する。１２はＣＲＴなどの表示装置、１４はキーボードであり、これらは机１６に載せられている。１８はこの机１６の下に収納されたスキャナ、２０は机１６の横に置かれたプリンタである。スキャナ１８はその前面上部にカートリッジ挿入口２２を持ち、ここに挿入されたカートリッジ２４（図２、３参照）に入っているマイクロフィルム２６の画像を読取る。読取った画像はコンピュータ本体１０内のＣＰＵなどにより所定の画像処理を施された後、表示装置１２に表示され、またプリンタ２０にプリント出力されたり、光磁気ディスクなどにメモリされたり、外部処理装置へ転送される。

【００１０】スキャナ１８は縦長の筐体２８を持ち、この筐体２８内の前部上方に供給側リール駆動部３０が、前部下方に巻取り側リール駆動部３２が配設されている。供給側リール駆動部３０は、カートリッジ挿入口２２にカートリッジ２４が挿入されると、カートリッジ２４を自動的に移動させて回転軸にリール２４Ａを係合させる。またフィルム２６の先頭を引き出して下方へ送り、巻取り側リール駆動部３２の巻取りリール３２Ａに導く。

【００１１】ここにフィルム２６は、図２、３に示すよ

うに、各リール駆動部３０、３２の間隙の後側すなわち筐体２８の前からみて奥側を通る。図３で３４、３４、３６、３６はフィルム２６のガイドローラである。従ってこの間隙と筐体２８の正面パネル２８Ａとの間に空間３８が形成され、ここに後記光源部５２が収容される。

【００１２】巻取り側リール駆動部３２は、図３に示すようにリール３２Ａに接触して走行するドライブベルト４０を持つ。このドライブベルト４０はガイドローラ４２、４４、駆動ローラ４６、エンコーダ４８、テンションローラ５０に巻掛けられ、駆動ローラ４６によりフィルム巻取り方向（矢印方向）に走行駆動される。

【００１３】５２は、前記両リール駆動部３０、３２の間の空間３８に収容される光源部であり、ランプ５４、反射鏡５６、コンデンサーレンズ５８や適宜のフィルター等を有する。図２で６０は電源回路部、６２はモータなどの電力制御回路部である。

【００１４】次にラインセンサ駆動部６４を説明する。ラインセンサ駆動部６４は投影レンズ６６と一体化されている。すなわち図３、４に示すように、ラインセンサ駆動部６４のフレーム（回転フレーム）６８には、投影レンズ６６を保持する筒部７０が一体形成されている。この筒部７０に保持される投影レンズ６６は固定焦点で約２倍の倍率を持つ。筒部７０は、筐体２８に固定されたフレーム（固定フレーム）７２に回動自在に保持されている。ここに筒部７０はフィルム２６に垂直な光軸７４を中心として回転する。

【００１５】回転フレーム６８の筒部７０と、固定フレーム７２に取付けられたサーボモータ７６のプーリ７６Ａとには、ベルト７８が巻掛けられている。そしてモータ７６の回転により回転フレーム６８は光軸７４を中心にして回動可能である。

【００１６】回転フレーム６８には、図４に示すように筒部７０と反対の面に可動台８０が取付られている。すなわちこの可動台８０は一対のガイドロッド８２、８２に摺動自在に保持され、筒部７０の開口付近を光軸７４に直交する方向へ往復動可能である。回転フレーム６８には可動台８０の往復方向と平行に、プーリ８４、８４に巻き掛けたベルト８６が設けられ、このベルト８６に可動台８０の一側が固定されている。また一方のプーリ８４にはサーボモータ８８の回転がベルト９０を介して伝えられる。この結果サーボモータ８８を正逆転させることによって、可動台８０を光軸７４に直交する平面上で往復動させることができる。

【００１７】可動台８０には、ガイドロッド８２、８２に直交する方向、すなわち可動台８０の往復方向に直交する方向に、長窓が形成されている。この長窓９２はその長さ方向の中心が光軸７４上に位置する。この可動台８０の後面すなわち筒部７０と反対側の面には、プリント配線基板９４が光軸７４に直交するように固定されている。

【００１８】この基板９４には長窓９２に臨むＣＣＤラインセンサ９６が固定されている（図３）。なおこの基板９４には、このラインセンサ９６の出力を増幅するプリアンプなども搭載されている。ＣＣＤラインセンサ９６の受光面は、投影レンズ６６の投影画像の結像面に一致させるのは勿論である。

【００１９】コンピュータ本体１０に内蔵されたＣＰＵ１００は、図５に示すような種々の機能を持つ。これらの機能はソフトウェアで形成されるが、図５ではこれらを便宜的にブロックで示すものである。検索制御手段１０２は、フィルム２６に予め付された検索用のブリップ（図示せず）を用いて目標のコマを検出する。すなわちフィルム２６の走行路に近接させたブリップセンサ１０４の出力をカウントする一方、巻取り側リール駆動部３２のモータ１０６および供給側リール駆動部３０のモータ（図示せず）を制御して、目標とするコマを求める。

【００２０】１０８はスキャン制御手段であり、目標コマが光軸７４を含む投影範囲の所定位置に入ると、ラインセンサ駆動部６４を作動させる。すなわちモータ８８を作動させ、ラインセンサ６６を画像の結像面上で平行移動させて投影画像の読取りを行う。なおこのスキャンの間は光源部５２のランプ５４を点灯させる。

【００２１】１１０は切換スイッチであり、１回目の予備スキャン時に図５のＡ側に接続され、２回目の本スキャン時にＢ側に切換えられる。１１２は黒枠検出手段であり、切換スイッチ１１０がＡ側に接続されている時にラインセンサ６６のスキャンによる画像信号を読込んで黒枠を検出する。

【００２２】この黒枠は、原稿の周囲の部分すなわちプリント時に原稿画像の外周に表れる部分である。黒枠の検出アルゴリズムは種々提案されている。例えばスキャンした時に黒枠から原稿に入ると一定画素数以上の黒の画素が連続した白の画素に変化することから黒枠と原稿の境界を検出することができる。

【００２３】このように黒枠が検出されると、次に傾き検出手段１１４は原稿の画像の傾きを求める。傾き補正手段１１６はこの傾きを補正するためにモータ７６を駆動する。この結果ラインセンサ駆動部６４全体が回転し、ラインセンサ６６を投影画像の一辺と平行にする。

【００２４】１１８は画像処理手段であり、切換スイッチ１１０がＢ側に接続され本スキャンを行うと、ラインセンサ６６の出力を読込んで所定の画像処理を行う。例えば画像強調、画像反転、画像の拡大・縮小、空間フィルタリング処理、トリミング、マスキング等の処理を行う。

【００２５】次にこの実施例の動作を説明する。カートリッジ２４がカートリッジ挿入口２２に挿入され、供給側リール駆動部３０に装填されると、フィルム２６の先頭が下方へ引き出される。そしてフィルム２６の先頭はガイドローラ３４、３４や３６、３６等にガイドされて

巻取り側リール駆動部３２に導かれる。フィルム２６の先頭はリール３２Ａとドライブベルト４０とに挟まれてリール３２Ａに巻付けられる。

【００２６】フィルム２６には予め検索用ブリップが付され、フィルム２６の走行中にはこのブリップがフォトトランジスタなどのブリップセンサ１０４（図５）により検出される（図６のステップ２００）。検索目標のコマは検索手段１０２においてこのブリップをカウントすることによって判別される。目標のコマが来ると、このコマを光軸７４を含む投影範囲（フレーム）内に位置決めしてフィルム２６の送りを停止する。そして次にこのコマの画像読取りが始まる。

【００２７】この最初の画像読取りは画像の傾きを求めるための予備的なものであるため、予備スキャンという（ステップ２０２）。この予備スキャンではスキャン制御手段１０８が、まず切換スイッチ１１０をＡ側に入れ、光源部５２のランプ５４を点灯する。するとコマの画像が投影レンズ６６で約２倍に拡大されて可動台８０に投影される。

【００２８】可動台８０はラインセンサ９６が投影画像の投影範囲全体を一方から他方へ向って移動するようにモータ８８で駆動される。この間ラインセンサ９６は結像面上の投影画像を読込む。このようにしてラインセンサ９６によるスキャン（予備スキャン）が行われる間、ラインセンサ９６の出力は基板上のプリアンプで増幅されて、コンピュータ本体１０に送られる。

【００２９】ＣＰＵ１００では、黒枠検出手段１１２によって投影画像に含まれている原稿の黒枠を求める（ステップ２０４）。そしてこの黒枠によって傾き検出手段１１４は画像の傾きを求める（ステップ２０６）。この傾きは、原稿の画像の周縁となる黒枠を検出することにより求めることができる。画像の傾きが求められると、回転フレーム６８をサーボモータ８８により回転させて傾きを０とする。すなわち黒枠の一辺にラインセンサ９６の長手方向を一致させる（ステップ２０８）。

【００３０】以上のスキャン動作は、画像とラインセンサ９６との傾きを一致させるための予備的なものであり、この予備スキャンの後に本来の画像を読取る本スキャンが行われる（ステップ２１０）。ラインセンサ９６は再び画像を読込み、この出力が画像処理手段１１８で画像処理され（ステップ２１２）、その結果はプリンタ１２０にプリント出力される（ステップ２１４）。またこの結果を光磁気ディスクなどの外部メモリ装置にメモリしたり、他の画像処理装置に出力する。

【００３１】なお多数のコマを連続して検索する場合には、本スキャンを終って画像信号をＣＰＵ１００にメモリした後であれば、直ちに次のコマの検索に入ることができる。この時には本スキャンを終ってから傾き補正を元の状態に戻すのが望ましい（図６のステップ２１６）。このように傾きを元の状態に戻すのは、ラインセンサ６６のスキャン範囲すなわち読取り範囲がフィルムのコマに対して逆方向に大きく傾いていると、画像がこのスキャン範囲から外れてしまい黒枠を正しく検出できなくなる状態が発生しうるからである。

【００３２】なおマイクロフィルムでは、通常光源部５２と投影レンズ６６の配置がこの実施例とは逆であるから、このような従来の装置に用いるマイクロフィルムを本実施例で用いた場合には投影画像は裏返えした画像になる。この場合には画像処理により正しい像に電気的に変換すればよく、このような処理は容易である。

【００３３】以上の実施例ではラインセンサ駆動部６４の回転中心軸を光軸７４に一致させているが、これらは一致させなくてもよい。通常投影範囲内の一側寄りに原稿の画像が写し込まれるから　この一側寄りにラインセンサ駆動部６４の回転中心軸を偏位させておくことにより原稿の画像がラインセンサのスキャン範囲から外れるおそれを少なくすることが可能である。図７～９はその原理を説明するものである。

【００３４】図７は図３、４で説明した実施例に対応するものであり、スキャン範囲Ｓを光軸７４を中心にして回転した場合を示す。この図でS_0はフィルム２６に対する傾き補正を行わない時のフィルム２６に対するスキャン範囲である。S_1は光軸７４を中心に反時計方向へ約２０°回転させたスキャン範囲である。

【００３５】今フィルム２６に撮影された原稿のコマ２６Ａが反時計方向へ約２０°傾いていれば、検出された黒枠に基づいて同角度だけラインセンサ駆動部６４が回転され、スキャン範囲S_0がS_1に変わる。この時には元のスキャン範囲S_0の隅付近の領域が新しいスキャン範囲S_1から外れることがある。図７でコマ２６ＡのうちΔＡＢＣの範囲内の斜線部分が読取れなくなる範囲である。傾き補正量が増えるにつれてこの読取れなくなる範囲は増える。なお図中２６Ｂはブリップであり、前記ブリップセンサ１０４（図５）により検出されるものである。

【００３６】図８は、スキャン範囲S_0の左辺の中心Ｄを中心にしてスキャン範囲S_0を反時計方向へ回転した場合を示す。S_2は新しいスキャン範囲である。他の条件は図７の場合と同じである。一般にコマ２６Ａは投影範囲の一側に寄せて写し込まれているから、このコマ２６Ａ寄りの辺に回転の中心Ｄを置くものである。このように回転の中心がコマ２６Ａに接近するため、コマ２６Ａが傾き補正後のスキャン範囲から外れることがなくなる。

【００３７】図９はフィルム２６の１／２幅にフィルム２６の長さ方向に順次１コマずつ撮影した場合を示す。このような撮影法としてはデュオ方式およびデュープレックス方式がある。デュオ方式は、フィルムを１／２幅ずつのＡチャネルとＢチャネルに区分けし、Ａチャネルに順次１コマずつ片側撮影してゆき、Ａチャネルの撮影

が終るとＢチャネルに逆方向から順次を撮影してゆくものである。デュープレックス方式は、原稿の表と裏とを同時にフィルム幅方向の隣接させて撮影してゆくものである。

【００３８】これらの方式のようにフィルムの１／２幅内にコマ２６Ｃ（図９）を撮影した場合には、コマ２６ＣとスキャンＳ。との間隔Ｌ（図９）が小さくなる。このため傾き補正の回転中心は、スキャン範囲Ｓ。のコマ２６Ｃ寄りの辺の中心Ｄよりも、コマ２６Ｃ側へ距離Ｘずらした点Ｅにするのが望ましい。この距離Ｘは傾き補正の最大角度と、間隔Ｌと、コマ２６Ｃの位置とを考慮して決定されるべきである。図９でＳ₁は傾き補正後のスキャン範囲である。

【００３９】次にこのように傾き補正の中心（ＤまたはＥ）を光軸７４から偏心させた実施例を図１０、１１を用いて説明する。図１０はこの実施例の一部を断面した側面図、図１１は図１０における基板９４およびラインセンサ９６を省いて右側から見た正面図である。なおこれらの図１０、１１では、前記図３、４と対応する部分に同一符号を付したのでその説明は繰り返さない。

【００４０】図１０、１１において固定フレーム７２Ａには内筒部７２Ｂが突設され、この内筒部７２Ｂの中心（回転中心）７２Ｃは投影レンズ６６の光軸７４に対して偏心している。また回転フレーム６８Ａにはこの内筒部７２Ｂの外側にラジアル軸受６８Ｂおよびスラスト軸受６８Ｃを介して保持される外筒部７０Ａが形成されている。この外筒部７０Ａはベルト７８を介しモータ７６によって回転される。

【００４１】なおこの回転フレーム６８Ａには、外筒部６８Ｂの外周面に３７のピン７０Ｂ（１つのみ図示）が等間隔に半径方向へ突設され、これらのピン７０Ｂが軸受７０Ｃを介して押えリング７０Ｄで押えられている。この結果外筒部７０Ａおよび回転フレーム６８Ａを固定フレーム７２Ａ側に保持する。

【００４２】またラインセンサ９６をスキャンさせるためのモータ８８Ａは、回転フレーム６８Ａの上部に取付けられ、その回転はベルト８８Ｂを介して中間プーリ８８Ｃに伝えられ、さらにベルト８８Ｄによって他の中間プーリ８８Ｅに伝えられる。モータ８８Ａの回転はこれらの中間プーリ８８Ｂ、８８Ｄにより減速され、可動台８０が固定されたベルト８６Ａを往復動させる。なお図１１でＳ∞はラインセンサ９６のスキャン範囲を示す。

【００４３】この実施例によれば、モータ７６の回転により回転フレーム６８Ａが外筒部７０Ａおよび内筒部７２Ｂの中心７２Ｃを中心にして回転する。この結果前記図８、９において説明したように傾き補正の中心を光軸７４から偏心させることができる。

【００４４】図３には投影レンズ６６がフィルム２６から離れた状態で示されているが、投影レンズの先端をフィルム側へ延出させ、フィルムを位置決めする透明ガラス板に摺動可能に当接させておいてもよい。このようにすれば、フィルムと投影レンズの相対的な位置決め精度が向上する。この投影レンズはラインセンサ駆動部の回転フレーム６８に保持されているから、結局フィルムと投影レンズとラインセンサ走行面との相対位置決め精度を高くできる。従って固定焦点かつ低倍率の投影レンズを用いても高精度な画像読取りが可能になる。

【００４５】

【発明の効果】請求項１の発明は以上のように、フィルムと平行な結像面との間に投影レンズを配設し、結像面上でラインセンサを平行移動させて画像を読取ると共に、ラインセンサのスキャン範囲を回転させて投影画像の傾き補正を行うようにした。このため反射鏡や像回転プリズムを用いることなく光学系を小型化でき、装置全体の小型化が可能になる。

【００４６】ここにラインセンサを保持する回転フレームは光学系（投影レンズ）の光軸を中心に回転させてもよいが、投影範囲内でコマの位置が予め決った一側に偏位している場合には、この偏位側に回転フレームの中心を偏位させるのが望ましい。このようにすれば、傾き補正時にコマの画像がラインセンサのスキャン範囲から外れるのを防止することができる（請求項２）。

【図面の簡単な説明】

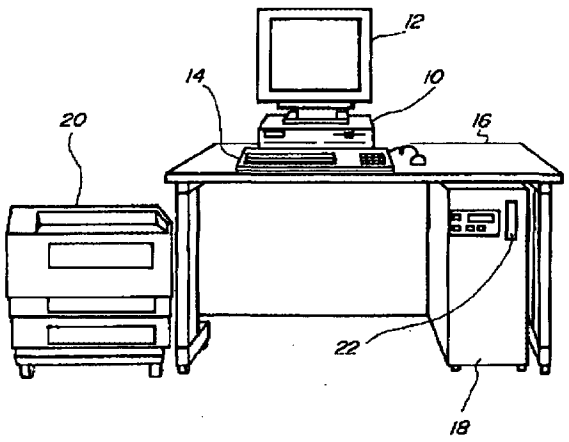
【図１】本発明の一実施例の使用状態を示す図
【図２】この実施例の透視斜視図
【図３】同じく要部の側面図
【図４】ラインセンサ駆動部を示す斜視図
【図５】制御系統を示すブロック図
【図６】動作の流れ図
【図７】傾き補正の説明図
【図８】傾き補正の説明図
【図９】傾き補正の説明図
【図１０】他の実施例の側面図
【図１１】同じく正面図

【符号の説明】

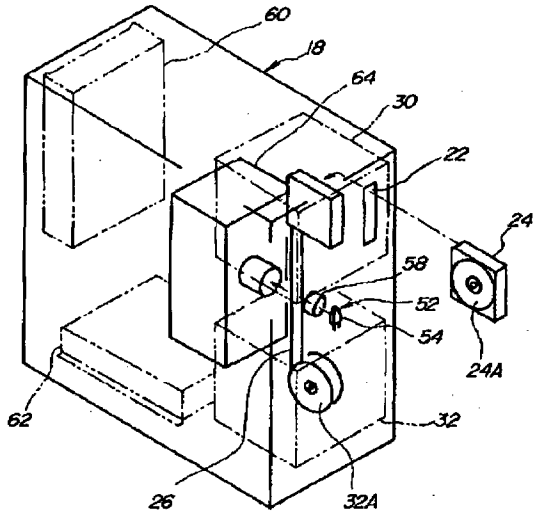
１０　コンピュータ本体
１２　表示装置
１８　スキャナ
２０　プリンタ
２２　カートリッジ挿入口
２４　カートリッジ
２６　マイクロフィルム
３０　供給側リール駆動部
３２　巻取側リール駆動部
５２　光源部
６４　ラインセンサ駆動部
６６　投影レンズ
６８、６８Ａ　回転フレーム
７２、７２Ａ　固定フレーム
７２Ｃ　回転中心

７４　光軸
８０　可動台
９２　長窓
９４　基板
＊９６　ＣＣＤラインセンサ
１００　ＣＰＵ
１１４　傾き検出手段
＊　１１６　傾き補正制御手段

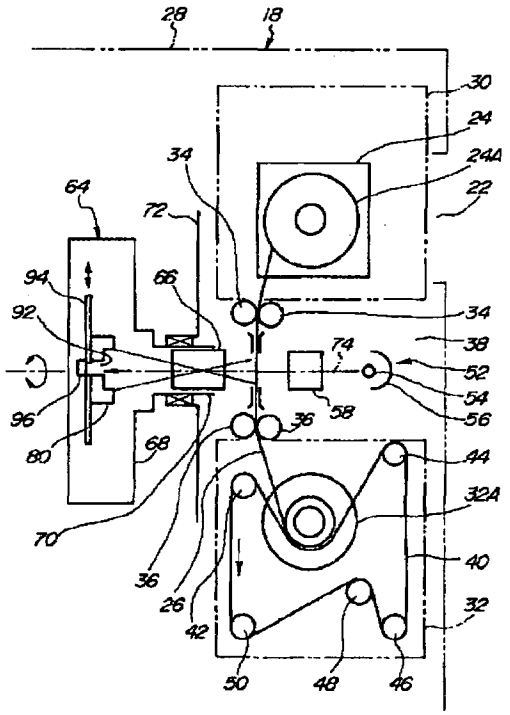
【図１】



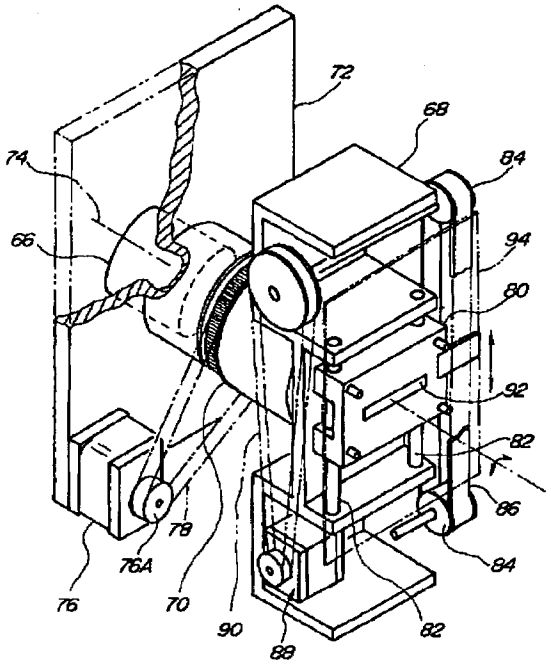
【図２】



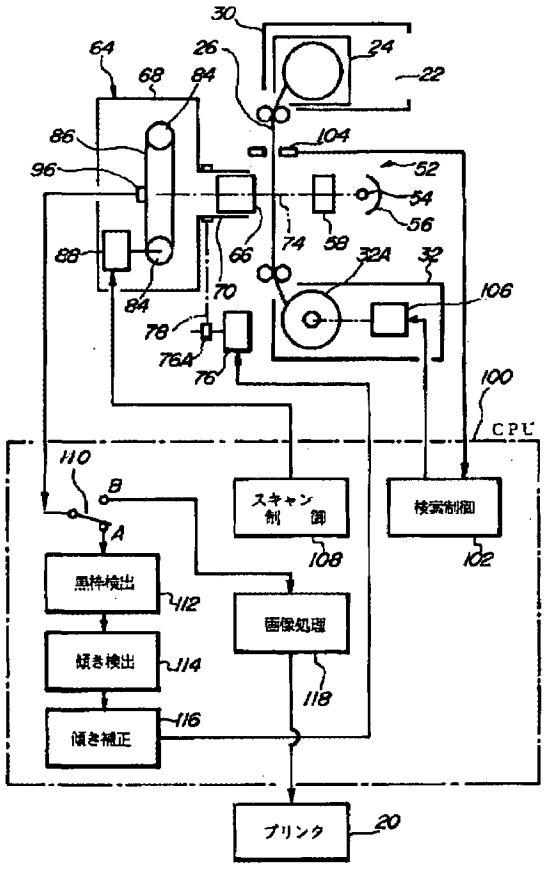
【図３】



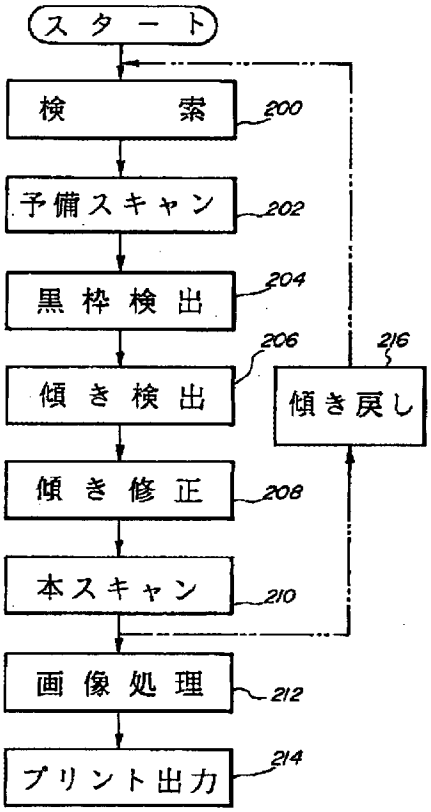
【図４】



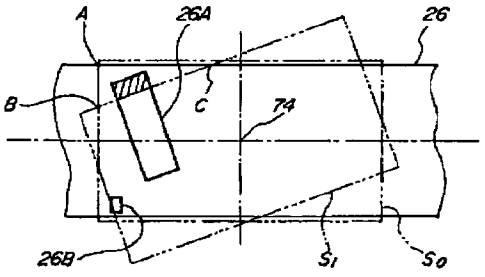
【図5】


30
64
26
24
22
68
84
86
104
96
52
54
56
74
58
66
88
32A
32
70
106
84
78
76A
76
100
CPU
110
B
A
スキャン制御
検索制御
108
102
黒枠検出
112
画像処理
傾き検出
114
118
傾き補正
116
プリンタ
20

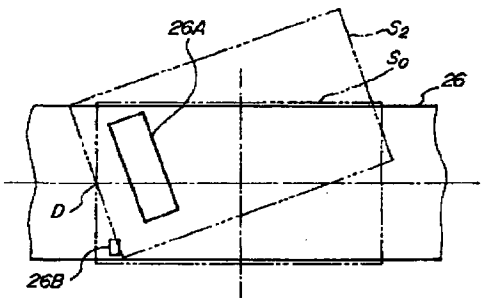
【図6】


スタート
検索
200
予備スキャン
202
黒枠検出
204
傾き検出
206
傾き戻し
216
傾き修正
208
本スキャン
210
画像処理
212
プリント出力
214

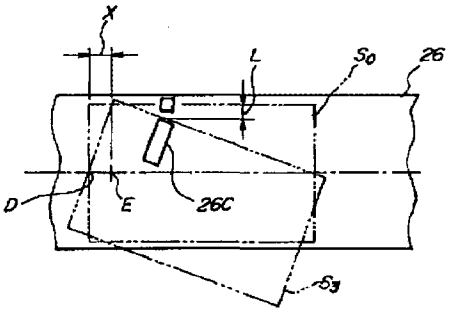
【図7】


A
26A
26
B
C
74
26B
S1
S0

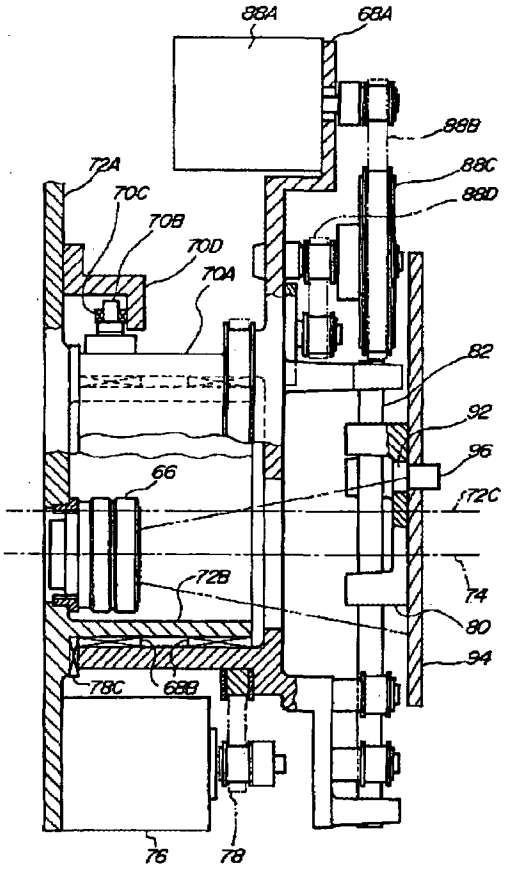
【図8】


26A
S2
S0
26
D
26B

【図９】


X
L
S_0
26
D
E
26C
S_3

【図１０】


68A
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68B
68C
68D
72A
70C
70B
70D
70A
82
92
96
66
72C
72B
74
80
94
78C
68B
76
78

【図11】